UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/979,505	01/11/2002	Takatomo Sasaki	2001-1739A	5933

513 7590 03/22/2004

WENDEROTH, LIND & PONACK, L.L.P.
2033 K STREET N. W.
SUITE 800
WASHINGTON, DC 20006-1021

EXAMINER	
SONG, MATTHEW J	
ART UNIT	PAPER NUMBER
1765	

DATE MAILED: 03/22/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/979,505	SASAKI ET AL.	
	Examiner	Art Unit	
	Matthew J Song	1765	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *05 January 2004*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *37-55* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *37-55* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 1/5/2004 has been entered.

Claim Rejections - 35 USC § 112

2. The following is a quotation of the first paragraph of 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

3. Claim 52 is rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter, which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention. Claim 52 recites, " a cooling mechanism operable to cool the raw material melt with which the seed crystal makes contact below a liquid level of the raw material melt and with a temperature drop rate of 0.1°C/day" in lines 10-12. The instant specification does not provided support for a cooling mechanism. The instant specification merely teaches the temperature is descended at a

rate of 0.1°C/day on page 11. The specification does not teach a cooling mechanism or means for obtaining the cooling rate.

4. Claims 51 and 52 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the enablement requirement. The claim(s) contains subject matter, which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention. Claim 51 recites, "slowly cooling comprises cooling the raw material melt with a temperature drop rate of 0.1°C/day" in lines 1-2. The instant specification merely teaches descending the temperature at a rate of 0.1°C/day on page 11. The instant specification does not teach the means which is used to obtain the cooling rate or any method of obtaining such a slow rate of cooling.

Claim Rejections - 35 USC § 103

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later

invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

6. Claims 37, 38, and 51-55 are rejected under 35 U.S.C. 103(a) as being unpatentable over Nakagawa et al (JP 63-190794), an English Abstract has been provided, in view of Kamio et al (US 5,126,144).

Nakagawa et al discloses a device for producing a single crystal in a Czochralski method by using a blade fitted concentrically with a pulling up shaft and purging scum incorporated in a crucible to the vicinity of the wall. Nakagawa et al also discloses a blade member **1**, which reads on applicants having a screw form, in Figure 2 located at the center of rotation of the crucible and adjacent to the inside bottom of the crucible in Figures 1 and 3. Nakagawa et al also discloses rotating the crucible, note the arrows indicating rotating the crucible in Figure 3. Nakagawa et al does not disclose rotating the blade member and the blade member is fixed to a pulling shaft **2**, this reads on applicant's rotating the crucible without rotating the blade member.

Nakagawa et al does not teach the raw material melt is heated and melted within a crucible by a resistance heater.

In a method of manufacturing a crystal using the Czochralski method, note entire reference, Kamio et al teaches all Czochralski (CZ) crystal are manufactured by conventional CZ process where crucible is rotated in a direction opposite to that of the crystal and a pool of raw material is heated mainly by an electric resistance heater which surrounds the side wall of a crucible. Kamio et al also teaches the combination of a rotating crucible and an electric resistance heater forces molten material to be agitated strongly by convection and a temperature

distribution, which is uniform and perfectly concentric to the crystal, is obtained on the molten surface. Kamio et al also teaches large crystal cannot be obtained without rotating and using a resistance heater. Kamio et al also teaches a seed crystal contacts a molten surface and crystal growth is performed along with solidification of the contacted surface, this reads on applicant's slowly cooling and precipitate the single crystal on the seed crystal (col 1, ln 25-65). It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify Nakagawa et al's CZ process with Kamio et al conventional resistance heater to grow large diameter crystals in a CZ process.

The combination of Nakagawa et al and Kamio et al does not teach a difference in temperature of the raw material melt between different positions along an extent from the liquid level to a depth of 10 cm is in a range of –0.5 to 0°C. However, this feature is inherent to the combination of Nakagawa et al and Kamio et al because a similar method of using a screw shaped blade in crucible and rotating the crucible, as applicants. Therefore, because applicants teach the difference in temperature of the raw material melt between different positions along an extent from the liquid level to a depth of 10 cm is in a range of –0.5 to 0°C is obtained by rotating the crucible, note page 11 and Figure 6 of the instant disclosure, the feature would be inherent to the combination of Nakagawa et al and Kamio et al.

Referring to claim 38, the combination of Nakagawa et al and Kamio et al teaches the crucible is rotated in the direction opposite to that of the crystal and a seed crystal is pulled gradually while the seed crystal contacts a molten surface ('114 col 1, ln 20-40), this reads on applicants the seed is rotated during rotating the crucible.

Referring to claim 51, the combination of Nakagawa et al and Kamio et al does not teach the slowly cooling comprises cooling the raw material melt with a temperature drop rate of 0.1°C/day. It is well known in the art in a Czochralski process to maintain the temperature of a melt at a temperature slightly above the solidification temperature, as evidenced by Li (US 5,824,149) below. Therefore, it would have been obvious to a person of ordinary skill in the art at the time of the invention to modify the combination of Nakagawa et al and Kamio et al by using slow cooling rate of 0.1°C/day to maintain the melt at a temperature slightly above the solidification temperature.

Referring to claim 52 and 55, the combination of Nakagawa et al and Kamio et al teaches a rotatable crucible 7, a blade member **1** having a screw form, a rotating device **8** ('794 Figs 1-3) and a resistance heater ('114 col 1, ln 30-60).

Referring to claim 52, the combination of Nakagawa et al and Kamio et al does not teach a cooling mechanism operable to cool the raw material melt with a temperature drop rate of 0.1 °C/day. The combination of Nakagawa et al and Kamio et al teach a resistance heating mechanism, as applicants, and applicants do not teach a cooling mechanism in the instant disclosure, the Examiner interprets the resistance heating means to act as a cooling mechanism. Therefore, the similar resistance heating means taught by the combination of Nakagawa et al and Kamio et al is inherently capable of intended use claimed by applicants.

Referring to claim 53, the combination of Nakagawa et al and Kamio et al teaches the crucible is rotated in the opposite direction to that of the crystal ('114 col 1, ln 30-40). The combination of Nakagawa et al and Kamio et al does not explicitly teach a mechanism for rotating the seed crystal. This is mechanism is inherent to the combination of Nakagawa et al and

Kamio et al because a rotating mechanism is required to rotate the crystal is in the opposite direction. Also, a mechanism for rotating the seed crystal in the CZ method is well known in the art, as evidenced by Nishizawa (US 4,874,458) below.

Referring to claim 54, the combination of Nakagawa et al and Kamio et al teaches a rotating device **8** mounted to the crucible and the stirring member **1** mounted to a separate shaft **2** ('794 Figs 1-3 and Abstract), this reads on applicant's arrange such that the rotating device can rotate the crucible without rotating the stirring member.

7. Claims 39-42 and 45-48 are rejected under 35 U.S.C. 103(a) as being unpatentable over Nakagawa et al (JP 63-190794), an English Abstract has been provided, in view of Kamio et al (US 5,126,144) as applied to claims 37, 38, and 51-55 above, and further in view of Sasaki et al (EP 0786542 A1).

The combination of Nakagawa et al and Kamio et al discloses all of the limitations of claim 5, as discussed previously, except a single crystal of oxide is grown.

In a method of forming a crystal, note entire reference, Sasaki et al teaches a cesium lithium borate crystal ($CsLiB_6O_{10}$) was grown by a seeding method (Example 1). Sasaki et al also teaches doping of a crystal by through mixing of compounds such as oxide and carbonates during preparation of a crystal, where Al and Ga are used as dopants to form $Cs_{1-x}Li_{1-y}M_{x+y}B_6O_{10}$ (pg 3, col 15-55 and claim 1). It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify the combination of Nakagawa et al and Kamio et al with Sasaki et al to grow a cesium-lithium borate crystal, which is useful as a wavelength converting nonlinear optical crystal for a laser oscillator (pg 2, ln 5-10).

8. Claims 39, 40, 43, 45, 46 and 49 are rejected under 35 U.S.C. 103(a) as being unpatentable over Nakagawa et al (JP 63-190794), an English Abstract has been provided, in view of Kamio et al (US 5,126,144) as applied to claims 37, 38, and 51-55 above, and further in view of Furuya et al (Development of New Nonlinear Optical Crystal GdYCOB with Tunable Birefringence).

The combination of Nakagawa et al and Kamio et al discloses all of the limitations of claim 5, as discussed previously, except a single crystal of oxide is grown.

In a method of forming a crystal by the Czochralski method, Furuya et al teaches a $Gd_xY_{1-x}Ca_4O(BO_3)_3$ grown by the Czochralski method (Abstract). It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify the combination of Nakagawa et al and Kamio et al with Furuya et al to form a $Gd_xY_{1-x}Ca_4O(BO_3)_3$ crystal which is useful in controlling the birefringence in nonlinear optical crystals.

9. Claims 39, 44, 45, and 50 are rejected under 35 U.S.C. 103(a) as being unpatentable over Nakagawa et al (JP 63-190794), an English Abstract has been provided, in view of Kamio et al (US 5,126,144) as applied to claims 37, 38, and 51-55 above, and further in view of Nitanda et al (US 5,359,452).

The combination of Nakagawa et al and Kamio et al discloses all of the limitations of claim 5, as discussed previously, except a single crystal of oxide is grown.

In a method of forming a crystal, note entire reference, Nitanda et al teaches a $LiTaO_3$ mixture is placed into a crucible and melt and then a seed was then dipped into the melt to grow a monocrystal by the Czochralski method (Embodiment 2). It would have been obvious to a

person of ordinary skill in the art at the time of the invention to modify the combination of Nakagawa et al and Kamio et al with Nitanda et al to form a Lithium Tantalate monocrystal, which is useful in surface acoustic elements (col 3, ln 50-67).

Response to Arguments

10. Applicant's arguments with respect to claims 37-55 have been considered but are moot in view of the new ground(s) of rejection.

Conclusion

11. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Li (US 5,824,149) teaches in a Czochralski process the melt is maintained at a temperature slightly above the solidification temperature of the charge material and when the seed is lowered into the melt material, it causes a local decrease in melt temperature (col 1, ln 15-40).

Nishizawa (US 4,874,458) discloses a rotation drive mechanism **9** for rotating a crystal pulling rod, which is attached to a seed crystal (col 5, ln 10-40).

Atami et al (US 5,871,581) teaches a spiral plate baffle, this reads on applicant's screw shape (col 4, ln 50-55).

Dornberger et al (US 5,868,831) teaches temperature gradients within a melt cause crystal striations, which are undesirable (col 1, ln 35-67) and a cooling rate of 0.1°C/day (col 3, ln 1-10).

Sato (US 5,788,764) teaches slow cooling at a rate of 1°C/day (col 10, ln 5-40).

Bordui et al (US 5,343,827) teaches a melt is cooled at a rate of not greater than 3°C/day (claims 1 and 8).

Gordon et al (GB 2084046) teaches an open baffle in stationary position in a Czochralski process (Abstract).

12. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Matthew J Song whose telephone number is 571-272-1468. The examiner can normally be reached on M-F 9:00-5:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nadine Norton can be reached on 571-272-1465. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Matthew J Song
Examiner
Art Unit 1765

MJS

NADINE G. NORTON
SUPERVISORY PATENT EXAMINER